CR 030 I2C

Low Power Low Cost Reader

User Manual

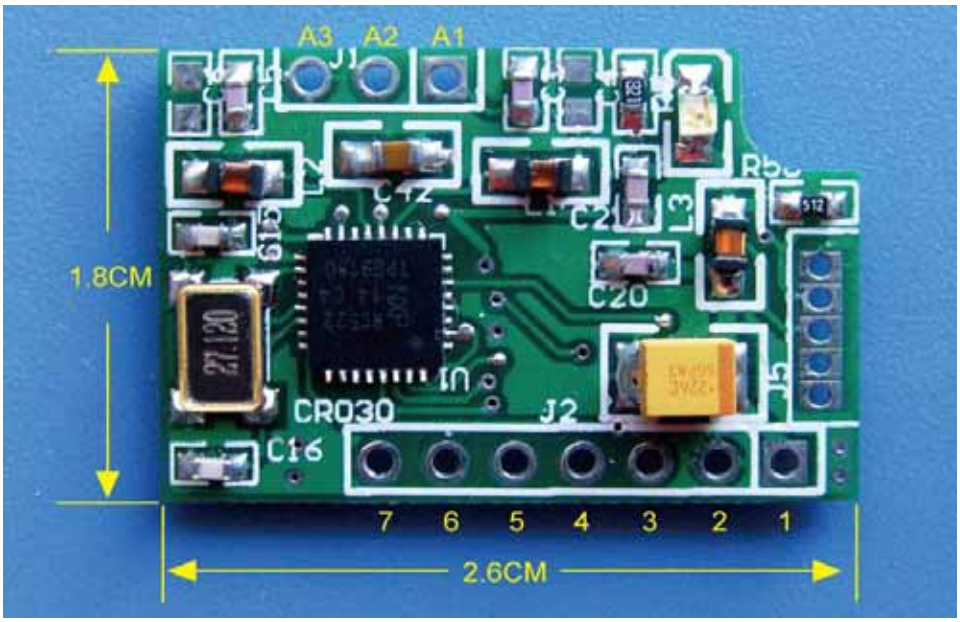
1. Mifare Standard

- 1024 bytes EEPROM, divided into 16 sectors with 64 bytes on each sector
- 100,000 write endurance cycles
- 10 years data retention
- ISO 14443 A
- 13.56MHz transponder frequency
- 106 kbit baud rate
- Bit-wise anti-collision
- Up to 10 cm operating distance
- 4 byte unique serial number
- Random number generator
- 2 bytes access key per sector
- Individual access condition for each sector
- Purse functionality

2. CR030 Technical Specification

- Power supply: 2.5 – 3.6 V, 40 - 60mA
- Interface: UART IIC（CR030I2C）
- Transmission speed: 19200 bps(UART)
- R/W distance of up to 50mm
- Storage temperature: -40 ºC ~ +125 ºC
- Operating temperature: -25 ºC ~ +70 ºC

3. Dimension & Pin Description



PIN

Pin	Name	description
1	VCC	2.5-3.6 v
2	GND	GND
3	Wake	Interrupt Wake signal
4	RXD	UART RXD
5	TXD	UART TXD
6	SCL	I2C SCL(CR030I2C)
7	SDA	I2C SDA(CR030I2C)
A1	Ant Tx	Antenna Tx
A2	Ant Rx	Antenna Rx
A3	Ant Gnd	Antenna GND

Character

Parameter	Min	Type	Max	Units
voltage	2.5	3.0	3.6	V
Current(Working)	40		60	ma
Current(Sleep)		<10		microamp
Initialization time	50		200	MS

Opertating temperature	−25	+85	℃
Storage temperature	−40	+125	℃

4.I2C Description

Clock and Data Conventions

Data states on the SDA line can change only during SCL LOW. SDA state changes during SCL HIGH are reserved for indicating start and stop conditions. Refer to Figures 1 and 2.

Start Condition

All commands are preceded by the start condition, which is a HIGH to LOW transition of SDA when SCL is HIGH. The CR030 continuously monitors the SDA and SCL lines for the start condition and will not respond to any command until this condition has been met.

Figure 1. Data Validity

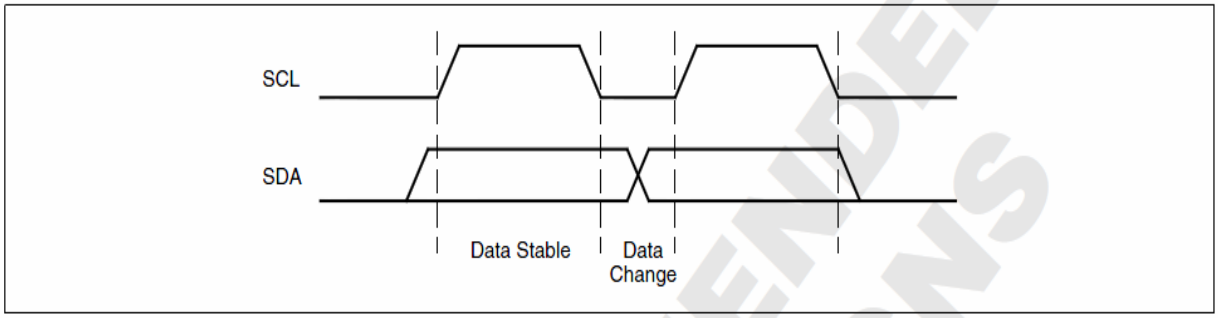
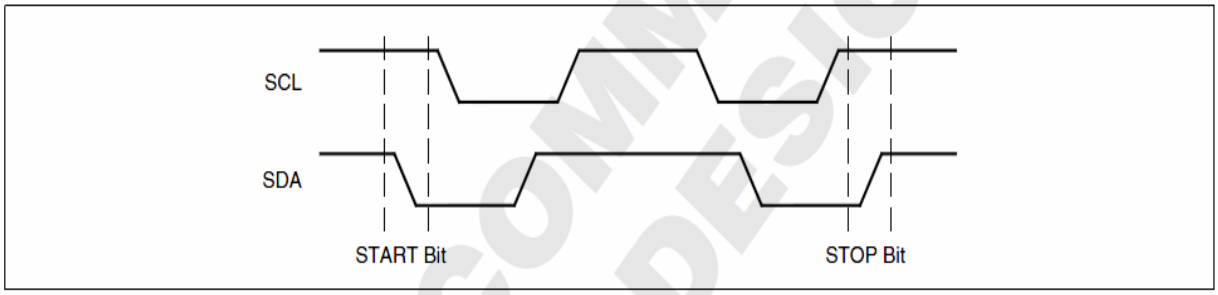


Figure 2. Definition of Start and Stop



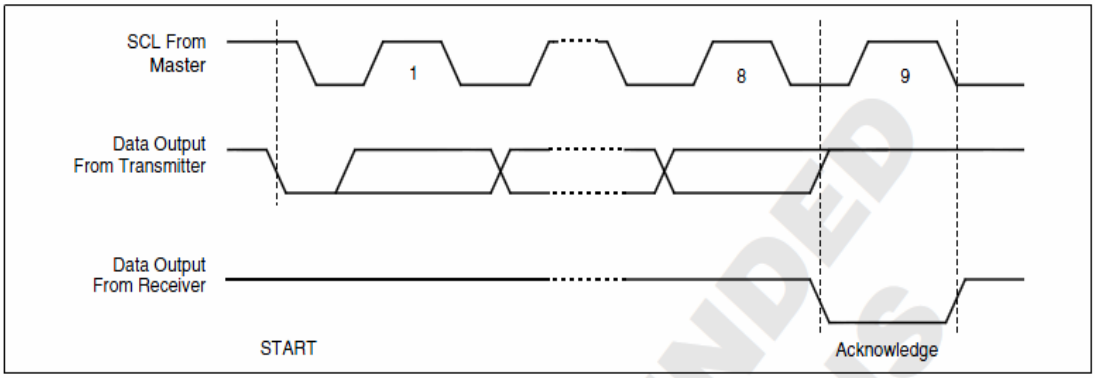
Stop Condition

All communications must be terminated by a stop condition,which is a LOW to HIGH transition of SDA when SCL is HIGH. The stop condition is also used by the CR030I2C to place the device in the standby power mode after a read sequence. A stop condition can only be issued

Acknowledge

Acknowledge is a software convention used to indicate successful data transfer. The transmitting device, either master or slave, will release the bus after transmitting eight bits. During the ninth clock cycle the receiver will pull the SDA line LOW to acknowledge that it received the eight bits of data. Refer to Figure 3. The CR030 will respond with an acknowledge after recognition of a start condition and its slave address. If both the device and a write operation have been selected, theCR030 will respond with an acknowledge after the receipt of each subsequent eight bit word.In the read mode the CR030 will transmit eight bits of data, release the SDA line and monitor the line for an acknowledge. If an acknowledge is detected and no stop condition is generated by the master, the CR030 will continue to transmit data. If an acknowledge is not detected, theCR030 will terminate further data transmissions. The master must then issue a stop condition to return the CR030 to the standby power mode and place the device into a known state.

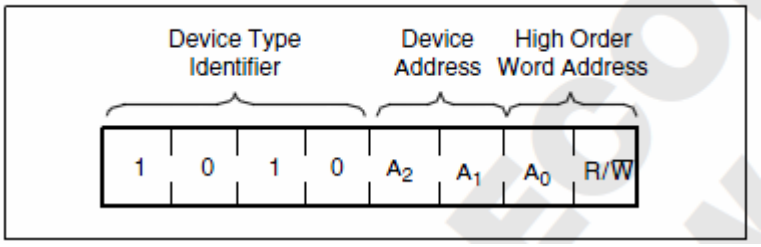
Figure 3. Acknowledge Response From Receiver



DEVICE ADDRESSING

Following a start condition the master must output the address of the slave it is accessing. The most significant four bits of the slave are the device type identifier (see Figure 4). For the CR030 this is fixed as 1010[B].

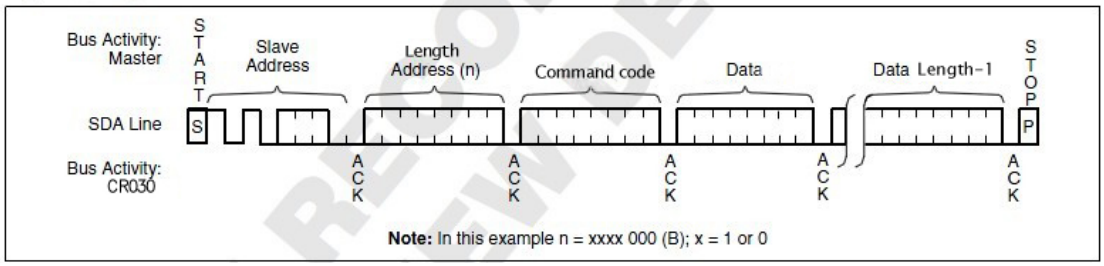
Figure 4. Slave Addressing



Write Data to Reader

The Host send a Command to CR030 via write operation, then CR030 will execute Command what Host sent . Finished time according to different order, most less than 50ms;

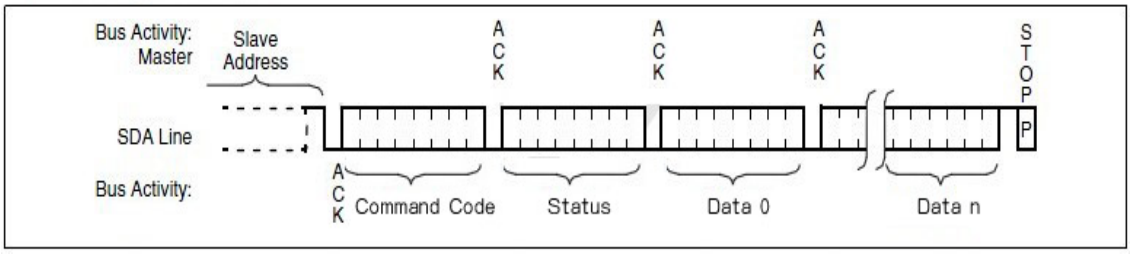
Figure 5. Page Write



READ Respond

The Host get Reader Respond by Read Operation;

Figure 6. Sequential Read



5. Command Format & Protocol

5.1 Command Format :

Host Write Data to Reader

Address	Length	Command	Data	
1 byte	1 byte	1 byte	Different length by Different Command	

Address : Reader working as slave mode , Host send data to Reader always Address is 0xA0;

Length : Length of Command + Data;

Command: Command Code to Reader ,Refer to Command List;

Data : Data , different parameter depend on different Commands ;

Host Read the Respond from Reader

Address	Length	Command	Status	Data
1 byte	1 byte	1 byte	1 bytes	Different length by different Command

Address : Reader working as slave mode , Host Read data from Reader always Address is 0xA1;

Length : Length should be Read by I2C , Command + Status + Data length ;
Command: Same as Command word just Execute;
Data : Data , what reader or Cards respond ;
During Reader execute the command , a Host Read should got fail respond .

5.2 Command List ：

1, 0x01 mifare Request
2, 0x02 mifare Anticollision
3, 0x03 Mifare select
4, 0x04 Mifare Halt
5, 0x05 Mifare Request a card (Request + Anticollision +select)
6, 0x07 Mifare Authentication
7, 0x08 Mifare Read
8, 0x09 Mifare Write
9, 0x0A Mifare initialize Purse
10,0x0B Mifare Read Vaule
11,0x0C Mifare Deccrement
12,0x0D Mifare Increment
13,0x0E Mifare Backup a block
14,0x12 Ultralight Card Anticollision
15,0x13 Ultralight Card write
16,0x14 PCD Antenna control
17,0x15 Reset Reader
18,0x16 Request Reader Status
19.0x17 Set Reader to Sleep Mode

5.3 Command Description

1, 0x01 mifare Request (refer to Command 5)

Host to Reader

Length	Command	Request Mode
0x02	0x01	1byte

Request mode

Request mode = 0x52: request all Type A card In filed

Request mode = 0x26: request idle card

Read Respond from Reader:

Command	Status	Data
0x01	1 byte	2 byte Mifare card Mark

Mifare Card Mark :

0x4400 = ultra_light
0x0400 = Mifare_One(S50)
0x0200 = Mifare_One(S70)
0x4403 = Mifare_DESFire

0x0800 = Mifare_Pro
0x0403 = Mifare_ProX

2, 0x02 mifare Anticollision (refer to Command 5)

Host write to Reader :

LENGTH	COMMAND
0x01	0x02

Read Data Respond :

Read 6 bytes

Command	Status	UID
0x02	1 byte	4bytes

Status = 0x00 Select a card success

UID : four byte card UID (cr030 default firmware for S50/s70 ,so here 4 byte UID)

3, 0x03 Mifare select (refer to Command 5)

Host to Reader

Length	Command	UID
0x02	0x03	4 byte

Read Respond from Reader:

Command	Status
0x03	1 byte

Status : 0x00 succeed select .

4, 0x04 Mifare Halt

Host write to Reader :

LENGTH	COMMAND
0x01	0x04

Read Data Respond :

Read 2 bytes

Command	Status
0x04	1 byte

Status = 0x00 Halt success

5, 0x05 Mifare Request a card (Request + Anticollision +select)

Host write to Reader :

LENGTH	COMMAND
0x01	0x05

Read Data Respond :

Read 8 bytes

Command	Status	Card Type	UID
0x05	1 byte	2bytes	4bytes

Status = 0x00 Select a card success

Card Type : 0x4400 = ultra_light
0x0400 = Mifare_One(S50)
0x0200 = Mifare_One(S70)

0x4403 = Mifare_DESFire

0x0800 = Mifare_Pro

0x0403 = Mifare_ProX

UID : four byte card UID (cr030 default firmware for S50/s70 ,so here 4 byte UID)

6, 0x07 Mifare Authentication

Host Send to Reader :

Length	Command	Authentication mode	block	keys
0x09	0x07	1byte	1byte	6bytes

Authentication Mode : 0x60 Key A , 0x61 Key B

Block : block number which block should be Authentication

Key : 6 bytes Key;

Read Respond : 2 bytes

Command	Status
0x09	1 byte

Status : if 00 means authentication succeed.

7, 0x08 Mifare Read

Host to Reader

Length	Command	Block Number
0x02	0x08	1byte

Block number : what block shold be read , Mifare s50 0 – 63 ,S70 0 – 255 ;

Read Respond From Reader :

Read 18 bytes

Command	Status	Data of block
0x08	1 byte	16 bytes of Data

8, 0x09 Mifare Write

Host to Reader :

Length	Command	Block Number	Data should be write
0x12	0x09	1byte	16bytes

Block Number : what block should be write : Mifare s50 0 – 63 , S70 0- 255;

Read Respond From Reader :

Command	Status
0x09	1byte Status

Status : 0x00 means Write command succeed .

9, 0x0A Mifare initialize Purse

Host to Reader :

Length	Command	Block Number	Data

0x06	0x0A	1 byte	4 bytes

Read Respond From Reader :

Command	Status
0x0A	1 byte

Status : 0x00 initialize succeed.

10,0x0B Mifare Read Vaule

Host to Reader :

Length	Command	Block number
0x02	0x0B	1byte block number

Read Respond from Reader :

6 bytes should be reader

Command	Status	Data
0x0B	1 byte Status	4 byte Data

Status : 0x00 read succeed .

11,0x0C Mifare Deccrement

Host To Reader :

Length	Command	Block Number	Data
0x06	0x0C	1 byte block number	4 byte Data

Read Respond From Reader :

Command	Status
0x0C	1 byte

Status : 0x00 means Write Succeed .

12,0x0D Mifare Increment

Host To Reader :

Length	Command	Block Number	Data
0x06	0x0D	1 byte block number	4 byte Data

Read Respond From Reader :

Command	Status
0x0D	1 byte

Status : 0x00 means Write Succeed .

13,0x0E Mifare Backup a block

Host To Reader :

Length	Command	Block Number	Block Number
0x03	0x0E	1 byte block number of Source	Block number of target

Read Respond From Reader :

Command	Status
0x0E	1 byte

Status : 0x00 means Write Succeed .

14,0x12 Ultralight Card Anticollision

Host write to Reader :

LENGTH	COMMAND
0x01	0x12

Read Respond 7 Bytes :

Command	Status	UID
0x12	1 byte	7 Bytes card UID

Status : 0x00 select a ultralight card ;

UID : 7bytes UID of Ultralight card;

15,0x13 Ultralight Card write

Host To Reader

Length	Command	Page	Data
0x06	0x13	Page number of write	Four byte data

Read Respond from Reader;

Command	Status
0x13	1 byte

Status : 0x00 means writ succeed;

Ultralight Read refer to Command 7 mifare Read.

16,0x14 PCD Antenna control

Host write to Reader :

LENGTH	Command	Data
0x02	0x14	1byte

Data : 0 ,close field ; 1 , open field.

Read Respond from Reader;

Command	Status
0x14	1 byte

Status : 0x00 means Control Reader Field succeed;

17,0x15 Reset Reader

Host write to Reader :

LENGTH	COMMAND
0x01	0x15

No respond , after receive this command reader should Reset .

18,0x16 Request Reader Status

Host write to Reader :

LENGTH	COMMAND
0x01	0x16

Read Respond from Reader;

Command	Status	Status of Reader
0x16	1 byte	1 byte

Status : 0x00 means Request Reader status succeed;

Status of Reader : 1 means Rfid Circuit working fine , 0 fail.

It is result of Reset RFID chip .

19.0x17 Set Reader to Sleep Mode

Host write to Reader :

LENGTH	COMMAND
0x01	0x17

No respond , after receive this command reader should turn to Sleep mode ,

Low active on Wake pin can wake up Reader.